

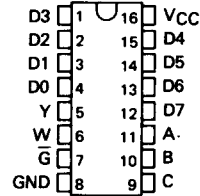
**SN54251, SN54LS251, SN54S251,  
SN74251, SN74LS251, (TIM9905), SN74S251  
DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS**

DECEMBER 1972—REVISED MARCH 1988

- Three-State Versions of '151, 'LS151, 'S151
- Three-State Outputs Interface Directly with System Bus
- Perform Parallel-to-Serial Conversion
- Permit Multiplexing from N-lines to One Line
- Complementary Outputs Provide True and Inverted Data
- Fully Compatible with Most TTL Circuits

SN54251, SN54LS251, SN54S251 . . . J OR W PACKAGE  
SN74251 . . . N PACKAGE  
SN74LS251, SN74S251 . . . D OR N PACKAGE

(TOP VIEW)

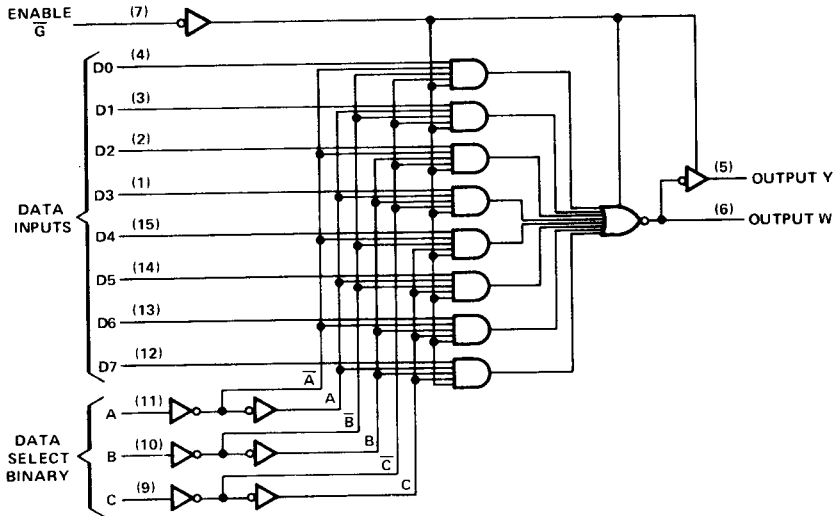


TYPE	MAX NO. OF COMMON OUTPUTS	TYPICAL AVG PROP DELAY TIME (D TO Y)	TYPICAL POWER DISSIPATION
SN54251	49	17 ns	250 mW
SN74251	129	17 ns	250 mW

SN54LS251, SN54S251 . . . FK PACKAGE

**SN54251, SN54LS251, SN54S251,  
SN74251, SN74LS251, (TIM9905), SN74S251  
DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS**

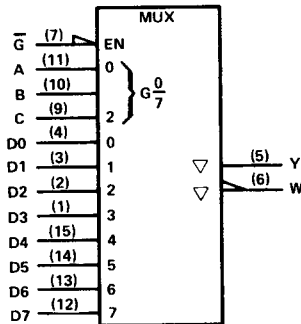
logic diagram (positive logic)



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logic symbol†



†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12. Pin numbers shown are for D, J, N, and W packages.

# SN54251, SN74251 DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage	5.5 V
Off-state output voltage	5.5 V
Operating free-air temperature range: SN54251	-55°C to 125°C
SN74251	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

## recommended operating conditions

	SN54251			SN74251			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC}$	4.5	5	5.5	4.75	5	5.25	V
High-level output current, $I_{OH}$			-2			-5.2	mA
Low-level output current, $I_{OL}$			16			16	mA
Operating free-air temperature, $T_A$	-55		125	0		70	°C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
$V_{IH}$ High-level input voltage		2			V
$V_{IL}$ Low-level input voltage				0.8	V
$V_{IK}$ Input clamp voltage	$V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$			-1.5	V
$V_{OH}$ High-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = \text{MAX}$	2.4	3.2		V
$V_{OL}$ Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 16 \text{ mA}$		0.2	0.4	V
$I_{OZ}$ Off-state (high-impedance-state) output current	$V_{CC} = \text{MAX}, V_{IH} = 2 \text{ V}$			40	$\mu\text{A}$
	$V_O = 2.4 \text{ V}$			-40	
$V_O$ Output clamp voltage	$V_{CC} = \text{MAX}, V_{IH} = 4.5 \text{ V}$			-1.5	V
	$I_O = -12 \text{ mA}$			$V_{CC} + 1.5$	
$I_I$ Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$			1	mA
$I_{IH}$ High-level input current	$V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$			40	$\mu\text{A}$
$I_{IL}$ Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$			-1.6	mA
$I_{OS}$ Short-circuit output current §	$V_{CC} = \text{MAX}$	-18		-55	mA
$I_{CC}$ Supply current	$V_{CC} = \text{MAX},$ All inputs at 4.5 V, All outputs open		38	62	mA

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.

‡All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ .

§Not more than one output should be shorted at a time.

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# SN54251, SN74251 DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	A, B, or C (4 levels)	Y	$C_L = 50\text{ pF}$ , $R_L = 400\ \Omega$ , See Note 2	29	45	ns	
$t_{PHL}$				28	45		
$t_{PLH}$	A, B, or C (3 levels)	W		20	33	ns	
$t_{PHL}$				21	33		
$t_{PLH}$	Any D	Y		17	28	ns	
$t_{PHL}$				18	28		
$t_{PLH}$	Any D	W		10	15	ns	
$t_{PHL}$				9	15		
$t_{PZH}$	$\bar{G}$	Y		17	27	ns	
$t_{PZL}$				26	40		
$t_{PZH}$	$\bar{G}$	W	17	27	ns		
$t_{PZL}$			24	40			
$t_{PHZ}$	$\bar{G}$	Y	$C_L = 5\text{ pF}$ , $R_L = 400\ \Omega$ , See Note 2	5	8	ns	
$t_{PLZ}$				15	23		
$t_{PHZ}$	$\bar{G}$	W		5	8	ns	
$t_{PLZ}$				15	23		

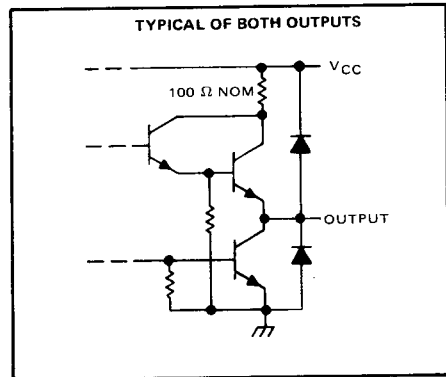
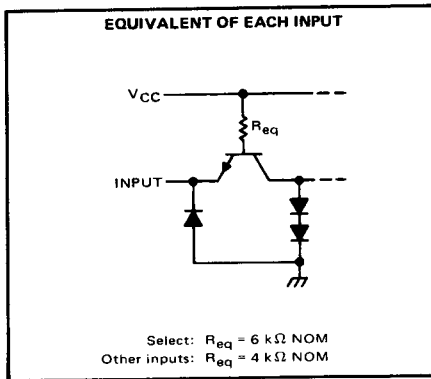
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† $t_{PLH}$  = Propagation delay time, low-to-high-level output  
 $t_{PHL}$  = Propagation delay time, high-to-low-level output  
 $t_{PZH}$  = Output enable time to high level  
 $t_{PZL}$  = Output enable time to low level  
 $t_{PHZ}$  = Output disable time from high level  
 $t_{PLZ}$  = Output disable time from low level

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

schematics of inputs and outputs



# SN54LS251, SN74LS251 DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage	7 V
Off-state output voltage	5.5 V
Operating free-air temperature range: SN54LS251	55°C to 125°C
SN74LS251	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

## recommended operating conditions

	SN54LS251			SN74LS251			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$ Supply voltage	4.5	5	5.5	4.75	5	5.25	V
$V_{IH}$ High-level input voltage	2			2			V
$V_{IL}$ Low-level input voltage			0.7			0.8	V
$I_{OH}$ High-level output current			-1			-2.6	mA
$I_{OL}$ Low-level output current			4			8	mA
$T_A$ Operating free-air temperature	-55		125	0		70	°C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	SN54LS251		SN74LS251		UNIT		
		MIN	TYP ‡	MAX	MIN		TYP ‡	MAX
$V_{IK}$	$V_{CC} = \text{MIN}$ , $I_I = -18 \text{ mA}$			-1.5		-1.5	V	
$V_{OH}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{IL} = \text{MAX}$ $I_{OH} = \text{MAX}$	2.4	3.4		2.4	3.1	V	
$V_{OL}$	$V_{CC} = \text{MIN}$ , $V_{IH} = 2 \text{ V}$ , $V_{IL} = \text{MAX}$			0.25	0.4	0.25	0.4	V
$I_{OZ}$	$V_{CC} = \text{MAX}$ , $V_{IH} = 2 \text{ V}$	$I_{OL} = 4 \text{ mA}$				0.35	0.5	
		$I_{OL} = 8 \text{ mA}$						
$I_{OZ}$	$V_{CC} = \text{MAX}$ , $V_{IH} = 2 \text{ V}$	$V_O = 2.7 \text{ V}$				20	20	
		$V_O = 0.4 \text{ V}$				-20	-20	
$I_I$	$V_{CC} = \text{MAX}$ , $V_I = 7 \text{ V}$			0.1		0.1	mA	
$I_{IH}$	$V_{CC} = \text{MAX}$ , $V_I = 2.7 \text{ V}$			20		20	μA	
$I_{IL}$	Enable $\bar{G}$ All other	$V_{CC} = \text{MAX}$ , $V_I = 0.4$				-0.2	-0.2	
						-0.4	-0.4	
$I_{OS} §$	$V_{CC} = \text{MAX}$	-30		-130	-30		-130	mA
$I_{CC}$	$V_{CC} = \text{MAX}$ , See Note 3	Condition A		6.1	10	6.1	10	
		Condition B		7.1	12	7.1	12	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.

‡ All typical values are at  $V_{CC} = 5 \text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

§ Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

NOTE 3:  $I_{CC}$  is measured with the outputs open and all data and select inputs at 4.5 V under the following conditions:

- A. Enable grounded.
- B. Strobe at 4.5 V.

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# SN54LS251, SN74LS251 (TIM9905) DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	A, B, or C (4 levels)	Y	$C_L = 15\text{ pF}$ , $R_L = 2\text{ k}\Omega$ , See Note 2		29	45	ns
$t_{PHL}$					28	45	
$t_{PLH}$	A, B, or C (3 levels)	W			20	33	ns
$t_{PHL}$					21	33	
$t_{PLH}$	Any D	Y			17	28	ns
$t_{PHL}$					18	28	
$t_{PLH}$	Any D	W			10	15	ns
$t_{PHL}$					9	15	
$t_{PZH}$	$\bar{G}$	Y			30	45	ns
$t_{PZL}$					26	40	
$t_{PZH}$	$\bar{G}$	W		17	27	ns	
$t_{PZL}$				24	40		
$t_{PHZ}$	$\bar{G}$	Y	$C_L = 5\text{ pF}$ , $R_L = 2\text{ k}\Omega$ , See Note 2		30	45	ns
$t_{PLZ}$					15	25	
$t_{PHZ}$	$\bar{G}$	W			37	55	ns
$t_{PLZ}$					15	25	

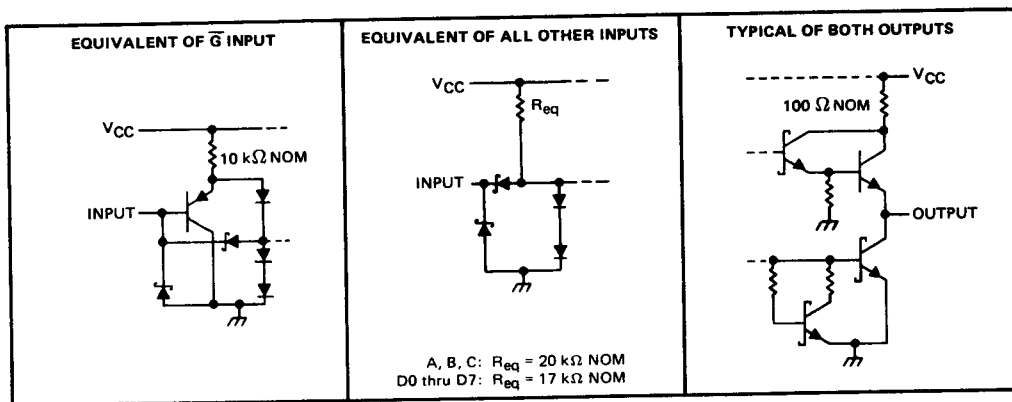
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TTL Devices

- † $t_{PLH}$  = Propagation delay time, low-to-high-level output
- † $t_{PHL}$  = Propagation delay time, high-to-low-level output
- † $t_{PZH}$  = Output enable time to high level
- † $t_{PZL}$  = Output enable time to low level
- † $t_{PHZ}$  = Output disable time from high level
- † $t_{PLZ}$  = Output disable time from low level

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

## schematics of inputs and outputs



# SN54S251, SN74S251 DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, $V_{CC}$ (see Note 1)	7 V
Input voltage	5.5 V
Off-state output voltage	5.5 V
Operating free-air temperature range: SN54S251	-55°C to 125°C
SN74S251	0°C to 70°C
Storage temperature range	-65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

## recommended operating conditions

	SN54S251			SN74S251			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, $V_{CC}$	4.5	5	5.5	4.75	5	5.25	V
High-level output current, $I_{OH}$			-2			-6.5	mA
Low-level output current, $I_{OL}$			20			20	mA
Operating free-air temperature, $T_A$	-55		125	0		70	°C

## electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST CONDITIONS <sup>†</sup>		MIN	TYP <sup>‡</sup>	MAX	UNIT
$V_{IH}$ High-level input voltage			2			V
$V_{IL}$ Low-level input voltage					0.8	V
$V_{IK}$ Input clamp voltage	$V_{CC} = \text{MIN}; I_I = -18 \text{ mA}$				-1.2	V
$V_{OH}$ High-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OH} = \text{MAX}$	SN54S <sup>†</sup>	2.4	3.4		V
		SN74S <sup>†</sup>	2.4	3.2		
$V_{OL}$ Low-level output voltage	$V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, V_{IL} = 0.8 \text{ V}, I_{OL} = 20 \text{ mA}$				0.5	V
$I_{OZ}$ Off-state (high-impedance-state) output current	$V_{CC} = \text{MAX}, V_{IH} = 2 \text{ V}$	$V_O = 2.4 \text{ V}$			50	$\mu\text{A}$
		$V_O = 0.5 \text{ V}$			-50	
$I_I$ Input current at maximum input voltage	$V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$				1	mA
$I_{IH}$ High-level input current	$V_{CC} = \text{MAX}, V_I = 2.7 \text{ V}$				50	$\mu\text{A}$
$I_{IL}$ Low-level input current	$V_{CC} = \text{MAX}, V_I = 0.5 \text{ V}$				-2	mA
$I_{OS}$ Short-circuit output current <sup>§</sup>	$V_{CC} = \text{MAX}$		-40		-100	mA
$I_{CC}$ Supply current	$V_{CC} = \text{MAX}, \text{All inputs at } 4.5 \text{ V}, \text{All outputs open}$			55	85	mA

<sup>†</sup>For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.

<sup>‡</sup>All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ .

<sup>§</sup>Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

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# SN54S251, SN74S251

## DATA SELECTORS/MULTIPLEXERS WITH 3-STATE OUTPUTS

switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{ C}$

PARAMETER†	FROM (INPUT)	TO (OUTPUT)	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	A, B, or C (4 levels)	Y	$C_L = 15\text{ pF}$ , $R_L = 280\ \Omega$ , See Note 2	12	18	ns	
$t_{PHL}$				13	19.5		
$t_{PLH}$	A, B, or C (3 levels)	W		10	15	ns	
$t_{PHL}$				9	13.5		
$t_{PLH}$	Any D	Y		8	12	ns	
$t_{PHL}$				8	12		
$t_{PLH}$	Any D	W		4.5	7	ns	
$t_{PHL}$				4.5	7		
$t_{PZH}$	$\bar{G}$	Y		$C_L = 50\text{ pF}$ , $R_L = 280\ \Omega$ , See Note 2	13	19.5	ns
$t_{PZL}$					14	21	
$t_{PZH}$	$\bar{G}$	W	13		19.5	ns	
$t_{PZL}$			14		21		
$t_{PHZ}$	$\bar{G}$	Y	5.5		8.5	ns	
$t_{PLZ}$			9		14		
$t_{PHZ}$	$\bar{G}$	W	5.5	8.5	ns		
$t_{PLZ}$			9	14			

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†  $t_{PLH}$  = Propagation delay time, low-to-high-level output

$t_{PHL}$  = Propagation delay time, high-to-low-level output

$t_{PZH}$  = Output enable time to high level

$t_{PZL}$  = Output enable time to low level

$t_{PHZ}$  = Output disable time from high level

$t_{PLZ}$  = Output disable time from low level

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

### schematics of inputs and outputs

